

A case study on illegal reptile poaching from Balochistan, Pakistan

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Abstract

The southwestern part of the Balochistan Province is a faunal extension of the Iranian Plateau in Pakistan, harboring more than one-third of Pakistan's known amphibian and reptile species. We carried out field visits in five districts of southwestern Balochistan during 2013–2017 to investigate the scale and hotspots of reptile poaching. We encountered 73 illegal collectors possessing 5,369 live reptiles representing 19 species in ten families. Overall, *Teratoscincus keyserlingii*, *T. microlepis* (both Sphaerodactylidae), *Phrynocephalus maculatus* and *P. luteoguttatus* (both Agamidae) were the most collected lizards, having a relative abundance of 22.4%, 13.5%, 11.9% and 11.3 %, respectively. *Eumeces schneiderii zarudnyi* (Scincidae) was among the least collected lizard. Similarly, *Lytrochilus maynardi* (Colubridae) and *Eryx tataricus speciosus* (Erycidae) were the most abundant snakes in the total collection (4.4% and 3.0%, respectively). Among the poached reptiles were internationally protected species: *Varanus griseus caspius* (Varanidae; CITES Appendix-I), *E. t. speciosus* (Appendix-II), *Naja oxiana* (Elapidae; Appendix-II), and *Saara asmussi* (Uromastycidae; Appendix-II). We found that the overall trend of illegal reptile poaching steadily decreased during the study period (from 1,724 individuals in 2013 to 633 in 2017). According to collectors, poached reptiles were largely destined for the local and international pet trade but also targeted other markets including folk medicines and snake charmer shows. One particular hotspot for the collection of reptiles was identified and should be a focus of law-enforcement activities. This particular case study partly demonstrates the effectiveness of strict enforcement of recently amended provincial wildlife protection legislation in the less studied regions of Asia.

Key Words

CITES Appendices, endemism, lizards, snakes, wildlife legislations

Introduction

There are several factors responsible for the decline in the wild species, including habitat fragmentation, alteration, and destruction, climate change, disease, ultraviolet radiation, xenobiotic chemicals and non-indigenous species. Moreover, in recent decades, poaching of wild animals for commercialization or subsistence contributed to the decline in certain species (Gibbons et al. 2000). Comprehensive studies demonstrating the links between illegal wildlife trade and wildlife declines are well-known (Zim-

merman 2003; Warchol 2007; South and Wyatt 2011). But very little is known about it from Pakistan, a country with high species diversity of reptiles (Khan 2006; Masroor 2012).

It is difficult to accurately quantify the global wildlife trade since it involves several channels from minor local to major international routes, and much follows informal networks (Karesh et al. 2005). The exploitation of reptiles for the pet trade has drawn the attention of experts since the late 1960s (Lambert 1969; Spellerberg 1976). Reptile populations are globally in decline (McCallum 2015).

Besides their use as food, reptiles are exploited for use in traditional medicine, pets, and religious rituals (Franke and Telecky 2001; Ceballos and Fitzgerald 2004; Zhou and Jiang 2004). In China, snakes are sold for religious and medicinal purposes (He and Peng 1999; Dharmananda 2007). Large freshwater turtles, sea turtles, and virtually all crocodilians have declined due to over-harvest (Klemens and Thorbjarnarson 1995). Over-collection for food and hide has driven tortoises to extinction and severe decline in many regions (Pritchard 1996). Moreover, illegal collections and subsequent massive releases of confiscated non-native populations may destroy pattern of species with low vagility (Vamberger et al. 2020). Trade in reptiles has been reviewed in some instances, such as trade in US reptile (Hoover 1998; Franke and Telecky 2001), chameleons (Carpenter et al. 2004), snake and reptile skins (Dodd 1986; Jenkins and Broad 1994; Fitzgerald and Painter 2000; Zhou and Jiang 2004) and the trade of freshwater turtles destined for the Southeast Asian market (Jenkins 1995; van Dijk et al. 2000). All these preceding studies were mainly focused on CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) species and their results might not have differentiated between legal vs. illegal trade.

The illegal poaching and trade in the wild flora and fauna in Pakistan are largely undocumented. This can also truly be said for the province of Balochistan as we find no report on the trade and illegal poaching of wild species. There is marginal information about medicinal uses of wild flora and fauna but otherwise, the commercialization and harvest, market dynamics, and conservation impact of these activities is unknown (Mahmood et al. 2011; Rais et al. 2012; Altaf et al. 2017; Amjad et al. 2017; Aziz et al. 2018). Regarding the illegal trade in reptiles, the first known report from Pakistan involved trade in soft-shelled turtles (Shah 1996). Later on, Baig (2006) documented the mass killing of freshwater turtles at Taunsa Barrage. Noreen and Khan (2007a, b), Noreen et al. 2008, Noreen 2009 further explored illegal poaching and trade in freshwater turtles from the Indus River, providing socio-economic analysis of the market. Ilyas (2008) documented cases of people involved in keeping live crocodiles at their homes in Karachi. He also recorded a number of provincially protected wild animals on sale in the market and further asserted that the trend of keeping wild animals as pets in posh areas has given a boost to the illegal animal trade. Mahmood et al. (2011) reported on the trade of animals in the pet shops of Rawalpindi and Multan and concluded that the increase of average sale price of animal species caused a decrease in volume of trade in the market.

In addition, reports by print and electronic media have emerged highlighting the confiscations of various reptile species from Pakistan and thus by commending the efforts of law enforcement agencies. In 2013, Pakistani nationals were arrested by the Thai Royal Customs authority involved in illegal international trade of Indian star tortoise (*Geochelone elegans*) and Black Spotted

Turtle (*Geoclemys hamiltonii*) (TRAFFIC News 2013). In 2015, Pakistan Customs officials seized a consignment comprising meat, bones, and skulls of over 4,200 freshwater turtles (weighing 1,900 kg) that was being smuggled from the Karachi port to Hong Kong (PressTV News 2015). In 2017, a total of 350 Afghan tortoises (*Testudo horsfieldii*) were confiscated by the Customs Department and the culprit was arrested while transporting these specimens from Quetta to Karachi (Dawn News 2017). In 2018, Sindh Wildlife Department also seized 151 chelonians including 129 freshwater turtles, nine marine green turtles and 13 tortoises (Dawn News 2018). A number of sizeable confiscations of other reptile species (mainly freshwater turtles and tortoises in genera *Testudo*, *Nilssonina*, *Lissemys* and *Geoclemys*) and their parts have been reported from across the country but the volume of trade and the amount of revenue involved was not determined. Earlier, a report of the CITES (Zoology) office of the Federal Agency for Nature Conservation in Bonn, Germany identified problems with illegal exports of thousands of live specimens of reptiles from Pakistan to Germany (Baig 2000, in correspondence).

Because of all available evidence including reports by print and electronic media, CITES and the overall declining status of reptiles in Pakistan, we investigated the extent of illegal reptile collection in southwestern Balochistan to determine what impact it might have on wild populations. Furthermore, we interviewed the collectors and gathered data on different aspects of reptile trade. Such an appraisal will enable this document to provide important context and baseline data from which future studies in the region can draw much useful information.

Materials and methods

We conducted field trips to Chagai, Nushki, Panjgur, Kharan and Washuk districts in Balochistan during 2013–2017 (Fig. 1). The visits were carried out after communication with local contacts, passing information about the activities of illegal collections in their areas. Visits lasted for 15 days in July 2013, 12 days in September 2014, 20 days in August 2015, 8 days in May 2016, and 18 days in June 2017. We conducted structured interviews with collectors after getting their verbal consent for participation in our investigation. Such an approach is highly recommended in the highly hierarchical tribal society in Balochistan. Without any negative consequences for collectors, they provided information on the location of capture, habitat features/microhabitat from which live reptiles were collected, collection method and utilization of reptile species.

We identified all the poached specimens of reptiles with the help of updated keys available in the literature (Anderson 1999; Khan 2006; Masroor, 2012; Nasrabadi et al. 2017). We counted numbers of illegally collected reptiles for all five surveys. The status of the International Union for Conservation of Nature (IUCN Red List



Figure 1. A topographic map of southwestern Balochistan showing visit sites in Chagai, Nushki, Panjgur, Kharan and Washuk districts.

of Threatened Species. <http://www.iucnredlist.org>) and CITES species (<https://www.cites.org/eng/app/appendices.php>) were assessed and noted.

Results

During visits conducted from 2013 to 2017, seventy-three illegal collectors were interviewed in five districts of southwestern Balochistan. Most of the collectors were encountered in Nushki ($n = 26$), followed by Chagai ($n = 19$), Kharan ($n = 12$), Panjgur ($n = 9$) and Washuk ($n = 7$). The poachers not only possess live reptiles (Fig. 2) but also equipment used for a collection of reptiles including small sets of pit-fall traps/buckets ($n = 438$) and the wooden transport boxes ($n = 38$, see Fig. 3). The area-wise data of reptiles from collectors revealed a higher number of collections from Nushki district, followed by Chagai, Panjgur and Kharan. The least number of reptiles was collected from Washuk district (Fig. 4A). The area-wise poached reptiles belonged to the following families: Agamidae (Nushki, Chagai, Panjgur, Kharan, Washuk); Gekkonidae (Chagai, Panjgur, Kharan); Sphaerodactylidae (Nushki, Chagai, Kharan); Scincidae (Nushki, Chagai, Panjgur, Kharan); Uromastycidae (Panjgur, Kharan); Varanidae (Nushki, Chagai, Panjgur, Washuk); Erycidae (Nushki); Colubridae (Nushki, Chagai, Panjgur, Kharan, Washuk); Elapidae (Chagai, Kharan); Viperidae (Nushki, Chagai, Panjgur).

Most of the collectors worked in groups (each group consisting of six to twelve people), they were male, aged between 14 to 50 years and spreading all over the present study areas, during the summer season. They were all illiterate and their sole livelihood was based on reptile poaching, trade, and street shows. These collectors were well-organized and had trapping equipment for the collection of reptiles. Apart from collecting the lizards by hand-picking and snakes through snake clutches, small sets of pitfall traps were mostly used by the collectors for collecting



Figure 2. A view of live reptiles. *Lytorhynchus maynardi* and *Eryx tataricus speciosus*, the two rarely encountered snakes inside the locally-made boxes.



Figure 3. A view of wooden boxes for transportation of reptiles by illegal collectors.

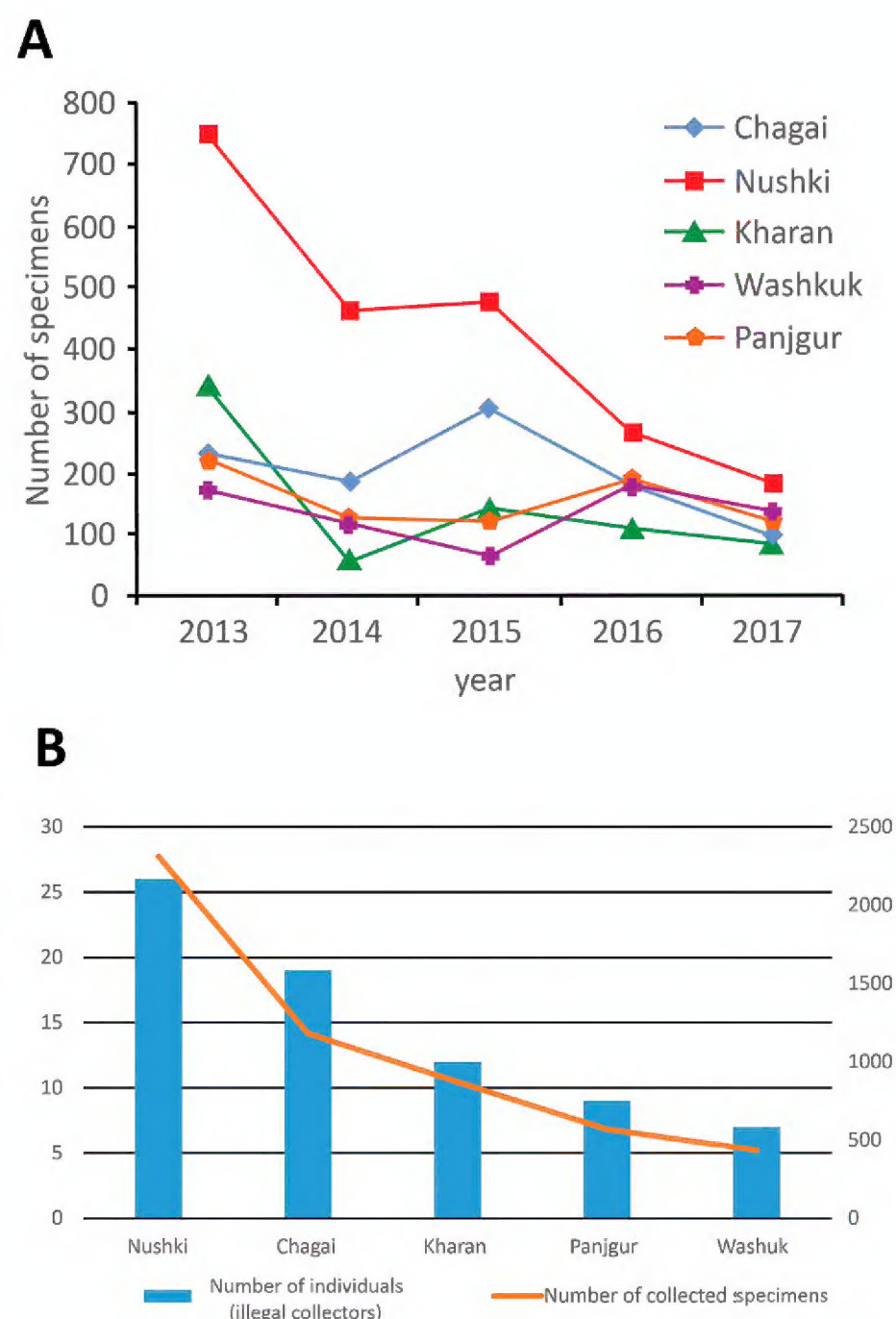


Figure 4. A – number of reptiles collected illegally from five districts of southwestern Balochistan during visits from 2013 to 2017 B – number of specimens collected against the number of individuals (illegal collectors).

small lizards and snakes. These groups were locally known as “jogeez”, who mainly originated from Sindh Province and included snake charmers, having their roots deep with the local *hakeems* (herbal medicine practitioners) and wildlife traders, businessmen and exporters based at Karachi city. To maximize their collection, the collectors were

reported to pay a nominal stipend of 50 to 300 Pakistani rupees (= 0.30 to 2.0 USD) to few locals for the collection of each live lizard or snake specimen. We often observed local people killing lizards and snakes, mostly for fear of venom and part for fun and centuries-old myths.

A total of 5,369 reptiles (Nushki = 2311 individuals, Chagai = 1181, Kharan = 872, Panjgur = 570, Washuk = 435; Tab. 1, Fig. 1) representing 19 species were illegally collected during our investigation (Table 1). Nevertheless, the illegal collection of reptiles steadily decreased during the study period from 1,725 individuals in 2013 to 632 in 2017. Among the lizards, *T. keyserlingii* (22.4%), *Teratoscincus microlepis* (13.5%), *P. maculatus* (11.9%), *P. luteoguttatus* (11.3%) and *Agamura p. persica* (9.5%) were, respectively, the most abundant in the illegal collection. *Eumeces schneiderii zarudnyi* (0.8%), *P. clarkorum* (0.9%), and *V. g. caspius* (0.9%), were, respectively, the least collected lizards. *Lytorhynchus maynardi* (4.4%), *E. t. speciosus* (3.0%) and *P. mintonorum* (1.0%) appeared to be the most abundant snakes in descending order of collection. *Naja oxiana* (Elapidae), and two members of Viperidae, *Pseudocerastes persicus*, *Eristicophis macmahoni* were represented by 0.2%, 0.1% and 0.8%, respectively. Three species of geckos (*T. keyserlingii*, *T. microlepis*, *A. p. persica*), also favorite lizards in the international pet trade, were contributing slightly less than 50% of the total illegal collection and thus clearly pointing towards the exploitation of these species in

the international pet trade. Family Agamidae contributed about 30% of the total illegal collection.

For lizards and snakes dwelling in sand dunes/sandy plains, collectors mostly used the pitfall traps (Tab. 2). Species inhabiting the other four habitats i.e., dry streambeds, mountains/hills, gravel plains, and clayey plains were mostly harvested by bare hands. Snakes were usually collected by snake clutches. Most of the illegal collection of reptiles was destined for entering the international pet trade and to some extent in the preparation of local herbal medicines by the quacks. The extent of utilization of some lizards, especially species in the genus *Phrynocephalus*, was largely (about 82%) unknown to the collectors. The utilization of *N. oxiana*, *E. macmahoni* and *P. persicus* in the trade was not fully known, however fewer collectors (about 10%) related the use of these snakes for venom extraction or for snake charmers (Tab. 2).

For the species appearing in reptile poaching, one species was Data Deficient (*N. oxiana*) and all other species were either Not Evaluated or were declared Least Concern in terms of IUCN conservation status. From the point of view of wildlife trade, the illegally collected *V. g. caspius* is listed in CITES Appendix-I and *E. t. speciosus*, *N. oxiana* and *S. asmussi* are assessed and listed in Appendix-II. Moreover, all the 19 reptile species appearing in illegal collection had also been declared protected under Schedule-III of the Balochistan Provincial Wildlife Act (available from http://pabalochistan.gov.pk/pab/pab/tables/alldocuments/actdocx/2019-09-19_14:51:46_ca72a.pdf).

Table 1. Consolidated data showing the number of reptiles collected illegally by groups of people from southwestern Balochistan during visits from 2013 to 2017 reflecting the share of each species in the illegal collection (relative abundance) and IUCN and CITES status. [NE (Not Evaluated), LC (Least Concern), DD (Data Deficient)].

Families	2013	2014	2015	2016	2017	Relative Abundance	IUCN status	CITES Appendix
Agamidae								
<i>Phrynocephalus clarkorum</i>	–	–	27	–	21	0.9	NE	–
<i>Phrynocephalus luteoguttatus</i>	153	101	87	195	68	11.3	LC (stable)	–
<i>Phrynocephalus maculatus</i>	156	–	212	147	126	11.9	NE	–
<i>Phrynocephalus ornatus</i>	112	59	–	120	30	6.0	LC (stable)	–
<i>Phrynocephalus scutellatus</i>	–	24	–	27	19	1.3	NE	–
Gekkonidae								
<i>Agamura persica persica</i>	173	90	131	68	47	9.5	LC (stable)	–
Sphaerodactylidae								
<i>Teratoscincus microlepis</i>	254	167	111	101	90	13.5	NE	–
<i>Teratoscincus keyserlingii</i>	324	279	315	176	107	22.4	LC (stable)	–
Scincidae								
<i>Eumeces schneiderii zarudnyi</i>	24	–	–	9	10	0.8	NE	–
<i>Ophiomorus tridactylus</i>	239	67	121	–	72	9.3	NE	–
Uromastycidae								
<i>Saara asmussi</i>	87	–	21	–	–	2.0	NE	II
Varanidae								
<i>Varanus griseus caspius</i>	25	–	11	6	8	1.0	NE	I
Erycidae								
<i>Eryx tataricus speciosus</i>	33	59	–	48	21	3.0	NE	II
Colubridae								
<i>Lytorhynchus maynardi</i>	94	59	68	13	–	4.4	LC (unknown)	–
<i>Platycephalus mintonorum</i>	24	7	–	12	9	1.0	NE	–
<i>Spalerosophis diadema schirazianus</i>	–	31	13	–	–	0.8	NE	–
Elapidae								
<i>Naja oxiana</i>	7	3	–	2	–	0.2	DD	II
Viperidae								
<i>Eristicophis macmahoni</i>	15	12	–	10	5	0.8	NE	–
<i>Pseudocerastes persicus</i>	4	–	3	–	–	0.1	LC (decreasing)	–
Total	1724	958	1120	934	633			

Table 2. Data reported by illegal collectors showing habitat, collection method and utilization of reptiles from southwestern Balochistan. (SD= sand dunes/sandy plains; DS= dry stream-beds; MH= mountains/hills; GP= gravel plains; CP= clayey plains; BH= bare hands; PT= pitfall trapping; IM= preparation of indigenous medicines recipes; IPT= international pet trade; NK= not known; PS= in-country pet shows by snake charmers; SC= snake clutch; SV= snake venom extraction).

S. No.	Species	Habitat	Collection method	Utilization
Agamidae				
1	<i>Phrynocephalus clarkorum</i>	90%= SD 10%= DS	90%= SC 10%= PT	90%= NK 10%= IM
2	<i>Phrynocephalus luteoguttatus</i>	100%=SD	94%= PT 6%= BH	79%= NK 21%= IM
3	<i>Phrynocephalus maculatus</i>	60%= CP 30%= DS 10%= GP	100%= BH	90%= NK 10%= IM
4	<i>Phrynocephalus ornatus</i>	100%=SD	100%= PT	70%= NK 30%= IM
5	<i>Phrynocephalus scutellatus</i>	60%= GP 40%= DS	100%= BH	80%= NK 20%= IM
Gekkonidae				
6	<i>Agamura persica persica</i>	60%= MH 30%= DS 10%= GP	100%= BH	75%= IPT 20%= IM 5%= PS
Sphaerodactylidae				
7	<i>Teratoscincus microlepis</i>	100%=SD	60%= BH 40%= PT	100%= IPT
8	<i>Teratoscincus keyserlingii</i>	100%=SD	75%= BH 25%= PT	100%= IPT
Scincidae				
9	<i>Eumeces schneiderii zarudnyi</i>	70%= CP 30%= MH	100%= BH	80%= IPT 20%= IM
10	<i>Ophiomorus tridactylus</i>	100%= SD	100%= PT	100%= IM
Uromastycidae				
11	<i>Saara asmussi</i>	60%= DS 30%= MH 10%= GP	100%= BH	60%= IPT 30%= PS 10%= IM
Varanidae				
12	<i>Varanus griseus caspius</i>	40%= DS 30%= MH 10%= GP 10%= CP 10%= SD	100%= BH	50%= IM 30%= IPT 20%= PS 10%= NK
Boidae				
13	<i>Eryx tataricus speciosus</i>	90%= SD 10%= CP	80%= PT 20%= SC	90%= IPT 10%= PS
Colubridae				
14	<i>Lytorhynchus maynardi</i>	90%= SD 10%= CP	70%= PT 40%= SC	80%= IPT 20%= PS
15	<i>Platyceps mintonorum</i>	80%= SD 20%= CP	100%= SC	90%= NK 10%= IPT
16	<i>Spalerosophis diadema schirazianus</i>	80%= CP 20%= SD	100%= SC	50%= NK 50%= IPT
Elapidae				
17	<i>Naja oxiana</i>	70%= MH 40%= DS	100%= SC	70%= NK 30%= PS 10%= SV
Viperidae				
18	<i>Eristicophis macmahoni</i>	95%= SD 5%= CP	100%= SC	90%= NK 10%= SV
19	<i>Pseudocerastes persicus</i>	90%= MH 5%= DS	100%= SC	90%= NK 10%= SV

Discussion

In Pakistan, the issue of illegal collections and trade of reptiles has been neglected for decades. Minton (1966)

pioneered the field of herpetology in Pakistan and described issues during his field collection. He used local snake charmers and professional collectors from Sindh province to collect reptiles, especially snakes, and would pay out a stipend to them in return. In his words “*During the first two years in Pakistan* [referring to 1958–1959], *I bought very few specimens from snake charmers and other professional collectors; from late 1960 onward, I obtained numerous specimens in this manner*” (Minton 1966: 34). Such an approach resulted in the collection of thousands of specimens by the snake charmers, often without the knowledge of their population dynamics. These snake-hunting groups have not abandoned hunting the snakes and other reptiles for monetary gain even after Minton’s short stay in Pakistan had ended. During the present study, the reptile-hunting groups also confirmed their involvement by the Sera Processing Laboratory of the National Institute of Health for the collection of venomous snakes in producing snake antivenom.

There are only anecdotal reports of illegal poaching of reptiles from other parts of Pakistan (Khan 2006; Rais et al. 2012; Ali et al. 2018) but for Balochistan, the situation still remains unexplored. At least 35 endemic reptile species exist in the desert basin of Seistan and Balochistan region in bordering areas of Afghanistan, Iran and Pakistan (Khan 1987, 1980; Anderson 1999; Baig et al. 2006) and recent studies suggest that this number is not final (Khan 2006; Nazarov et al. 2011). Pakistan has a duty under the Convention on Biological Diversity to protect its most vulnerable biological diversity, with the Balochistan region likely to be high priority due to the globally restricted ranges of those endemic species. In a situation where there is such fine-scale endemism, the activities of illegal poaching could result in the extirpation of endemic reptile species. Why the Balochistan still remains unexplored may be clearly attributed to the following reasons: 1) lack of environmental education and awareness of the valuable role these wild animals play in the environment, 2) lack of government environmental and wildlife protection agencies in creating awareness and conservation programs about threatened wildlife, 3) lack of resources and well-qualified workers in the provincial wildlife, forest and environment departments, 4) lack of coordination among wildlife, forest, environment, customs and law-enforcement agencies for curbing illegal wildlife trade, 5) geopolitical position and remoteness of vast tracts of areas together with local climatic conditions, and 6) lack of experts working on the systematics, population dynamics and other aspects of wildlife species. The Balochistan, as a part of the Palearctic-Oriental Transition zone (Sindaco and Jeremcenko 2008), represents one of the most important areas of Asia with a high number of endemic species of reptiles belonging to different genera (*Crossobamon*, *Cyrtopodion*, *Hemidactylus*, *Phrynocephalus*, *Acanthodactylus*, *Eremias*, *Eumeces*, *Ophiomorus*, *Lytorhynchus*, *Eristicophis*; Khan 2006), some of them reported during present surveys (Table 1).

The illegal collection of reptile species from southwestern Balochistan is posing a great threat to these poorly documented animals in understanding the connection between environment, species abundance and market chains (Tab. 2). It was revealed that information from collectors regarding the habitats of collected reptiles were mostly in accordance with the habitat associations of these species reported in published literature (Anderson 1999). In other words, the most abundant species are well searchable species living mostly on sandy habitats and collected probably during their evening or night peaks of activity. For example, *Phrynocephalus clarkorum*, *P. luteoguttatus*, *P. ornatus*, *Teratoscincus keyserlingii*, *T. microlepis*, *Lytorhynchus maynardi*, *E. t. speciosus*, *Platyceps mintonorum* and *E. macmahoni* are all habitat-specialists and barely venture out of sand dunes/sandy plains (Anderson 1999; Khan 2006), and the same habitat specificity was reported by poachers for these species. Similarly, *A. p. persica*, *V. g. caspius*, *N. oxiana*, and *P. persicus* are mostly reported from the mountains/hills (the same reported by collectors, Tab. 2), and because they are rare in the wild (except *A. p. persica*), it was reflected in their collected numbers (Tab. 1). On the other hand, our data show that the number of individuals in illegal collector groups is positively correlated with the number of collected reptile individuals (Fig. 4B).

Wildlife protection in Pakistan is a provincial subject, exercised by the relevant provincial and federal wildlife acts. The Schedule-I of the Balochistan Wildlife Act 2014 include game animals, which may be hunted under a valid license. The Schedule-II declares that no person can trade or sell species contained in CITES appendices and Convention on Migratory Species of Wild Animals without a valid certificate of lawful possession. Wild animals listed on Schedule-III are declared protected and cannot be hunted, killed, trapped, captured, traded, possessed or kept as pets. Under Schedule-III, the legislation provides an exhaustive list of 81 protected amphibians and reptiles from the territory of Balochistan including all 19 species that appeared in illegal poaching. Such a consideration by the province of Balochistan is commendable in terms of paving a way forward for the future viable conservation of herpeto-faunistic diversity. It is also promising that the illegal collection of reptile species from southwestern Balochistan has decreased manifold since 2013 (Fig. 4), which is partly attributed to strict enforcement of The Balochistan Wildlife Act 2014 by provincial wildlife authorities and support from the local NGO's like Chagai Conservation Society, Nushki Conservation Society and IUCN Sustainable Use Specialist Group. The Schedule-III of the Balochistan Wildlife Act 2014, however, contains also reptile species that are either misspelled, extra-limital for Pakistan or were never recorded in Balochistan: *Crocodylus porosus*, *Gavialis gangeticus*, *Python molurus*, *Eirenis perriea*, *Cyrtodactylus fedtschenkoi* (= *Tenuidactylus fedtschenkoi*), *Chamaeleo zeylanicus* or *Eutropis carinata*. This generally shows the low level of understanding of the provincial wildlife department and

specifically the lack of experts in the field of herpetology. As there exists no report or documentation on the illegal poaching of reptiles from Balochistan, the present report provides the first data for formulating prospective conservation strategies for these animals in the region.

The CITES only regulates the trade of fewer than 8% of worldwide recognized reptile species; therefore trade in the vast majority of species is not monitored or regulated. On the other hand, 45% of the world's reptile species has been assessed by the IUCN (Auliya et al. 2016). Wildlife trade regulations by countries may offer protection to the CITES-listed species but all the non-CITES species are left to endure the terrible consequences of high-value illegal wildlife trade. This is true for the present findings that there are only four species on the CITES list which appeared in illegal collection (*V. g. caspius*, *E. t. speciosus*, *N. oxiana* and *S. asmussi*), the rest are non-CITES species. Except for legislations in terms of Provincial Wildlife Acts for the protection and conservation of wildlife species, no specific provincial or national conservation assessment has been carried out for endemic or threatened reptiles of Balochistan. This is very important, as species of the genus *Varanus* or *Saara* are often collected for their skins, fat or for demonstration purposes in schools, colleges, and universities (Khan 1998, 2006).

As our data on the illegal collection of reptiles is only gathered from selected parts of southwestern Balochistan, we perceive that the actual size of the illegal collection could probably be greater than reported here. We therefore suggest that a comprehensive study on the illegal collection and trade of reptile species should be carried out so that the actual scale is reported from Pakistan. We also suggest that the provincial government and the federal government outline a specific strategy or plan for the conservation of endemic and threatened reptiles in southwestern Balochistan (and Pakistan) as part of their natural heritage. This plan must be consulted with scientific authorities to prevent improper handling of confiscated animals or their release to unsuitable or non-native areas (cf. Vamberger et al. 2020). We propose that illegal poaching of venomous snakes for the purpose of venom extraction should be strictly banned and might only be permitted after conducting thorough population surveys. Permits for trade in reptiles and other taxa endemic to Balochistan should not be issued unless the study is meant for proper research purposes. To conclude, the present study highlights the importance of this region in terms of prospective long-term conservation of endemic and threatened reptiles.

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References

- Ali W, Javid A, Hussain A, Bukhari SM (2018) Diversity and habitat preferences of amphibians and reptiles in Pakistan: a review. *Journal of Asia-Pacific Biodiversity* 11(2): 173–187. <https://doi.org/10.1016/j.japb.2018.01.009>
- Altaf M, Javid A, Umair M, Iqbal KJ, Rasheed Z, Abbasi AM (2017) Ethnomedicinal and cultural practices of mammals and birds in the vicinity of river Chenab, Punjab-Pakistan. *Journal of Ethnobiology and Ethnomedicine* 13(1): 1–41. <https://doi.org/10.1186/s13002-017-0168-5>
- Amjad MS, Arshad M, Saboor A, Page S, Chaudhary SK (2017) Ethnobotanical profiling of the medicinal flora of Kotli, Azad Jammu and Kashmir, Pakistan: Empirical reflections on multinomial logit specifications. *Asian Pacific Journal of Tropical Medicine* 10(5): 503–514. <https://doi.org/10.1016/j.apjtm.2017.05.008>
- Anderson SC (1999) *The Lizards of Iran*. Contributions to Herpetology (Vol. 15). Society for the study of amphibians and reptiles, Saint Louis, 442 pp.
- Auliya M, Altherr S, Ariano-Sanchez D, Baard EH, Brown C, Brown RM, Cantu JC, Gentile G, Gildenhuys P, Henningheim E, Hintzmann J, Kanari K, Krvavac M, Lettink M, Lippert J, Luiselli L, Nilson G, Nguyen TQ, Nijman V, Parham JF, Pasachnik SA, Pedrono M, Rauhaus A, Córdova DR, Sanchez M-E, Schepp U, van Schingen M, Schneeweiss N, Sy EY, Türkozan O, Vinke S, Vinke T, Vyas R, Williamson S, Zeigler T (2016) Trade in live reptiles, its impact on wild populations, and the role of the European market. *Biological Conservation* 204 (Part A): 103–119. <https://doi.org/10.1016/j.biocon.2016.05.017>
- Aziz MA, Khan AH, Adnan M, Ullah H (2018) Traditional uses of medicinal plants used by indigenous communities for veterinary practices at Bajaur Agency, Pakistan. *Journal of Ethnobiology and Ethnomedicine* 14(1): 1–11. <https://doi.org/10.1186/s13002-018-0212-0>
- Baig KJ (2006) Good-bye turtles. *The Nation*, 16 (published on July 14, 2006).
- Baig KJ, Awan MR, Ashraf N (2006) Ecological studies and zoogeographic affinities of the amphibians and reptiles found in Chagai Desert, Balochistan, Pakistan. *Pakistan Journal of Zoology* 38(4): 145–151.
- Carpenter AI, Rowcliffe JM, Watkinson AR (2004) The dynamics of the global trade in chameleons. *Biological Conservation* 120: 291–301. <https://doi.org/10.1016/j.biocon.2004.03.002>
- Ceballos CP, Fitzgerald LA (2004) The trade in native and exotic turtles in Texas. *Wildlife Society Bulletin* 32: 881–892. [https://doi.org/10.2193/0091-7648\(2004\)032\[0881:TTINAE\]2.0.CO;2](https://doi.org/10.2193/0091-7648(2004)032[0881:TTINAE]2.0.CO;2)
- Dawn News (2017) 350 Afghan tortoises seized, trafficker held. <http://www.dawn.com/news/1330031/> [Accessed on 29.02.2020]
- Dawn News (2018) 151 rare turtles, tortoises seized in Liaquatabad. <https://www.dawn.com/news/1330031/> [Accessed on 29.02.2020]
- Dharmananda S (2007) The medicinal use of snakes in China. <http://www.itmonline.org/arts/snakes.htm>.
- Dodd Jr CK (1986) Importation of live snakes and snake products into the United States, 1977–1983. *Herpetological Review* 17: 76–79.
- Fitzgerald LA, Painter CW (2000) Rattlesnake commercialization: Long-term trends, issues, and implications for conservation. *Wildlife Society Bulletin* 28: 235–253.
- Franke J, Telecky TM (2001) *Reptiles as pets: An examination of the trade in live reptiles in the United States*. The Humane Society of the United States, Washington.
- Gibbons JW, Scott DE, Ryan TJ, Buhlmann KA, Tuberville TD, Metts BS, Greene JL, Mills T, Leiden Y, Poppy S, Winne CT (2000) The global decline of reptiles, déjà vu amphibians. *Bioscience* 50: 653–666. [https://doi.org/10.1641/0006-3568\(2000\)050\[0653:TGDORD\]2.0.CO;2](https://doi.org/10.1641/0006-3568(2000)050[0653:TGDORD]2.0.CO;2)
- He H, Peng X (1999) Tentative survey on snake market in Guangzhou. *Sichuan Journal of Zoology* 18(3): 139–141. <https://doi.org/10.1080/026349399995812>
- Hoover C (1998) *The U.S. Role in the International Live Reptile Trade: Amazon Tree Boas to Zululand Dwarf Chameleons*. TRAFFIC North America Hughes, Washington.
- Ilyas F (2008) Illegal wild animals trade flourishing. *The DAWN*. <https://www.dawn.com/news/329262/karachi-illegal-wild-animals-trade-flourishing/> [Accessed on 25.02.2020]
- Jenkins MD (1995) *Tortoises and Freshwater Turtles: The Trade in South-east Asia*. TRAFFIC International, Cambridge, United Kingdom, 48 pp.
- Jenkins M, Broad S (1994) *International Trade in Reptile Skins: A Review and Analysis of the Main Consumer Markets, 1983–1991*. TRAFFIC International, Cambridge, United Kingdom, 68 pp.
- Karesh WB, Cook RA, Bennett EL, Newcomb J (2005) Wildlife trade and global disease emergence. *Emerging Infectious Diseases* 11: 1000–1002. <https://doi.org/10.3201/eid1107.050194>
- Khan MS (1980) Affinities and zoogeography of herpetiles of Pakistan. *Biologia* 26(1–2): 113–171.
- Khan MS (1987) Checklist, distribution and zoogeographic affinities of amphibian and reptiles of Balochistan. *Proc. 7th Pakistan Congress of Zoology*, 105–112.
- Khan MS (1998) Exploitation of herpetofauna of Pakistan. In: De Silva A (Ed.) *Biology and Conservation of the Amphibians, Reptiles and their Habitats in South Asia*. Proceedings of the International conference on the biology and conservation of the South Asian amphibians and reptiles. Amphibia and Reptile Research Organization of Sri Lanka, Peradeniya, 302 pp.
- Khan MS (2006) *Amphibians and Reptiles of Pakistan*. Krieger Publishing Company, Malabar, Florida, 311 pp.
- Klemens MW, Thorbjarnarson JB (1995) Reptiles as a food resource. *Biodiversity and Conservation* 4: 281–298. <https://doi.org/10.1007/BF00055974>
- Lambert MR (1969) Tortoise drain in Morocco. *Oryx* 10: 161–166. <https://doi.org/10.1017/S0030605300008164>
- Mahmood T, Shah SMA, Raees M, Nadeem MS (2011) An investigation of animal species trade at pet shops of Rawalpindi and Multan cities. *The Journal of Animal and Plant Sciences* 21(4): 822–829.
- Masroor R (2012) A contribution to the herpetology of northern Pakistan: The amphibians and reptiles of Margalla Hills National Park and surrounding regions. Society for the Study of Amphibians and Reptiles, Ithaca, New York, USA and Chimaira Buchhandels-gesellschaft mbH, Germany, 217 pp.
- McCallum ML (2015) Vertebrate biodiversity losses point to a sixth mass extinction. *Biodiversity and Conservation* 24: 2497–2519. <https://doi.org/10.1007/s10531-015-0940-6>

- Minton SA (1966) A contribution to the herpetology of West Pakistan. *Bulletin of the American Museum of Natural History* 134(2): 28–184.
- Nasrabadi R, Rastegar-pouyani N, Rastegar-pouyani E, Gharzi A (2017) A revised key to the lizards of Iran (Reptilia: Squamata: Lacertilia). *Zootaxa* 4227(3): 431–443. <https://doi.org/10.11646/zootaxa.4227.3.9>
- Nazarov RA, Ananjeva N, Papenfuss TJ (2011) A new species of thin-toed geckos *Cyrtopodion* sensu lato (Squamata: Sauria: Gekkonidae) from Balochistan Province, South Pakistan. *Russian Journal of herpetology* 18(2): 130–136.
- Noureen U, Khan A (2007a) Freshwater turtles of Pakistan: A preliminary assessment of their status in Dera Ismail Khan, North West Frontier Province. Ministry of Environment's Pakistan Wetlands Programme, 23 pp.
- Noureen U, Khan A (2007b) Freshwater turtles of Pakistan: A preliminary assessment of their status in Punjab and Sindh. Ministry of Environment's Pakistan Wetlands Programme, 23 pp.
- Noureen U, Braulik GT, Arshad M, Khan NH (2008) Illegal Trade in Freshwater Turtle Parts: Preliminary findings of turtle trade in major barrages and head-works of Punjab. Ministry of Environment's Pakistan Wetlands Programme, 28 pp.
- Noureen U (2009) Freshwater Turtles of Pakistan: Illegal trade in Sindh: Preliminary findings of trade in Freshwater Turtle Parts. Ministry of Environment's Pakistan Wetlands Programme, 36 pp.
- PressTVNews(2015) Pakistan customs seizes about 2 tons of smuggled turtle meat. <https://www.presstv.com/Detail/2015/03/06/400560/1900kg-turtle-meat-seized-in-Karachi> [Accessed on 29.02.2020]
- Pritchard PCH (1996) The Galápagos Tortoises: Nomenclatural and Survival Status. Chelonian Research Foundation, Lunenburg (MA), Chelonian Research Monographs (Vol. 1). 85 pp.
- Rais M, Baloch S, Rehman J, Anwar M, Hussain I, Mahmood T (2012) Diversity and conservation of amphibians and reptiles in North Punjab, Pakistan. *Herpetological Bulletin* 122: 16–25.
- Shah N (1996) Wildlife Trade in Sindh. WWF-Pakistan for TRAFFIC International, 57 pp.
- Sindaco R, Jeremcenko VK (2008) The reptiles of the Western Palearctic. Edizioni Belvedere, Latina (Italy), 579 pp.
- South N, Wyatt T (2011) Comparing illicit trades in wildlife and drugs: an exploratory study. *Deviant Behavior* 32(6): 538–561. <https://doi.org/10.1080/01639625.2010.483162>
- Spellerberg IF (1976) The amphibian and reptile trade with particular reference to collecting Europe. *Biological Conservation* 10: 221–232. [https://doi.org/10.1016/0006-3207\(76\)90036-7](https://doi.org/10.1016/0006-3207(76)90036-7)
- TRAFFIC News (2013) Royal Thai Customs intercept three attempts to smuggle tortoise and freshwater turtle in less than a week. <https://www.traffic.org/news/royal-thai-customs-intercept-three-attempts-to-smuggle-tortoise-and-freshwater-turtle-in-less-than-a-week/> [Accessed on 29.02.2020]
- Vamberger M, Spitzweg, C, de Silva A, Masroor R, Praschang P, Fritz U (2020) Already too late? Massive trade in Indian star tortoises (*Geochelone elegans*) might have wiped out its phylogeographic differentiation. *Amphibia-Reptilia* 41: 133–138. <https://doi.org/10.1163/15685381-20191215>
- van Dijk PP, Stuart BL, Rhodin AGJ [Eds] (2000) Asian Turtle Trade: Proceedings of a Workshop on Conservation and Trade of Freshwater Turtles and Tortoises in Asia. Lunenburg (MA), Chelonian Research Foundation. Chelonian Res. Monographs (Vol. 2). 2164 pp.
- Warchol G (2007) The transnational illegal wildlife trade. *Criminal justice studies: A critical journal of crime, law and society* 17(1): 57–73. <https://doi.org/10.1080/08884310420001679334>
- Zimmerman ME (2003) The black market for wildlife: combating transnational organized crime in the illegal wildlife trade. *Vanderbilt Journal of Transnational Law* 36: 1–1657.
- Zhou Z, Jiang Z (2004) International trade status and crisis for snake species in China. *Conservation Biology* 18: 1386–1394. <https://doi.org/10.1111/j.1523-1739.2004.00251.x>